

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1108

Roll No.

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## B. Tech.

(Semester-I) Theory Examination, 2012-13

### ENGINEERING CHEMISTRY

Time : 3 Hours]

[Total Marks : 80

Note : Attempt questions from each Section as per instructions.

#### Section-A

Attempt *all* parts of this question. Each part carries 2 marks.

2×8=16

1. (a) What are the short comings or drawbacks of valence bond theory in the case of coordination compounds?
- (b) Define the terms chromophore and auxochrome.

- (c) Discuss the terms— carbocations, carbanion, free radical, electrophilic and nucleophilic reagents.
- (d) Explain why metals are malleable and ductile.
- (e) What is a chiral molecule? Give two examples.
- (f) What is E- and Z- nomenclature? Why is it better than cis- and trans-nomenclature?
- (g) Standard hard water contains 15 g of  $\text{CaCO}_3$  per litre. 10 ml. of this required 50 ml of EDTA solution. Calculate the temporary hardness in the given sample of water.
- (h) An exhausted zeolite softener was regenerated by passing 150 litres of NaCl solution, having strength— 150 g/litre of NaCl. How many litres of hard water sample having a 600 ppm can be softened using this softener?

### ***Section-B***

Attempt any *three* parts of this question. Each part carries 8 marks.

$$8 \times 3 = 24$$

2. (a) A gaseous hydrocarbon 'A' on passing through a quartz tube heated at  $600^{\circ}\text{C}$  gave a colorless liquid, compound 'B' (Molecular weight, 78 amu). The latter compound was found to undergo electrophilic substitution reactions. It gave the following data on analysis :

The infrared spectrum exhibited a characteristic absorption band at  $3040\text{cm}^{-1}$  and a UV absorption at 204 nm, due to  $\pi-\pi^*$  electronic transitions.

The  $^1\text{H}-\text{NMR}$  spectrum displayed downfield singlet (6H) at 7.3 ppm. Identify the compounds 'A' and 'B' and give your reasoning.

- (b) Discuss the reactions involved in charging and discharging of a lead storage cell.
- (c) Outline the various advantages of thin-layer-chromatography.
- (d) Justify the statement that benzene molecule exhibits resonance.
- (e) What is meant by intermolecular and intramolecular hydrogen bonding?

### Section-C

Attempt *all* questions of this Section. Each question carries 8 marks.  $8 \times 5 = 40$

3. Attempt any two parts of the following :  $4 \times 2 = 8$
- (a) Outline the various methods used for the determination of order of a chemical reaction.
  - (b) With the help of energy profile diagram discuss the conformation of normal butane.
  - (c) Which method is employed to investigate whether or not the chemical reaction proceeds by  $S_N1$  or  $S_N2$  mechanism? Illustrate your answer with suitable examples.
4. Attempt any two parts of the following :  $2 \times 4 = 8$
- (a) What is inductive effect? Give two examples where this effect is operative.
  - (b) What are various types of nanocomposite materials?
  - (c) What are the conditions which make the polymer conducting?

5. Attempt any two parts of the following :  $4 \times 2 = 8$

- (a) What is electrochemical corrosion? Outline the mechanism-involved in electrochemical corrosion.
- (b) Write the chemical structure of polyisoprene. How would you crosslink the chains of polyisoprene?
- (c) Briefly discuss the structural information obtainable from IR, UV and proton-NMR data.

6. Attempt any two parts of the following :  $4 \times 2 = 8$

- (a) How would you obtain syndiotactic and isotactic polymers from propylene?
- (b) Outline the various methods used for the determination of order of a chemical reaction.
- (c) Mention briefly the type of van der Waal's forces.

7. Attempt any two parts of the following :  $4 \times 2 = 8$

- (a) How valence bond theory account for the following :

$[\text{Ni}(\text{CN})_4]^{2-}$  is diamagnetic and square planar,  $[\text{NiCl}_4]^{2-}$  is paramagnetic and tetrahedral,  $[\text{Ni}(\text{CO})_4]$  is diamagnetic and tetrahedral.

- (b) What is optical activity? Give the structure of stereoisomers of 3, 3-dihydroxy -1, 4-dioic acid. How do you account for the lack of optical activity in meso and racemic mixture?
- (c) Describe the properties of hydrogen bond and consequence of hydrogen bonding.